

MICROWAVE TOWER

JEFFERSON COUNTY

The Jefferson County Microwave Tower site was located on a hill 2 miles south of East Helena at 46° 33' 27" N and 111° 55' 01" W (Site No. 62 on Map II-1). Elevation at the site was 4,360 feet. The site was established by the Montana Air Quality Bureau to measure concentrations of particulates and sulfur dioxide in the area.

Wind data from the site that were available for analysis were collected from January 16, 1975, through December 31, 1981. The data set contains hourly averages of wind speed and wind direction manually reduced from stripchart records. Data were gathered by a Meteorology Research, Inc., mechanical recording anemometer and wind vane. Anemometer height was 4 meters.

Winds have been monitored long enough to adequately represent the wind resource at this location. The data, however, are representative only of a limited area on the northern slopes south of East Helena. Also, data recovery was poor, ranging from 24.1 percent in September to 53.0 percent in May. Overall data recovery was 39.3 percent.

Average monthly wind speeds ranged from 7.2 miles per hour in January to 13.4 miles per hour in December. Average annual wind speed was 10.8 miles per hour.

Average monthly wind power values ranged from 132.1 watts/m² in January to 415.3 watts/m² in December. Average annual wind power was 237.6 watts/m².

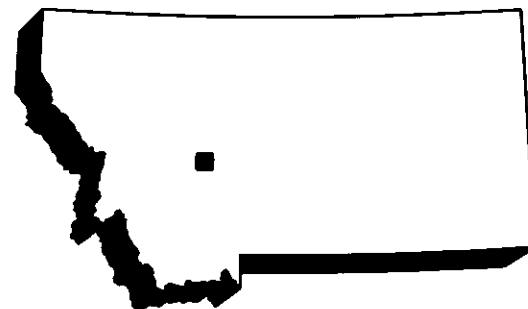


Table IV - 87

Monthly Wind Speed Distribution

JEFFERSON COUNTY - MICROWAVE TOWER

01/16/75 - 12/31/81

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	CALM
0.1-1.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1- 0.4
1.1-2.0	11.6	4.8	3.2	0.9	0.4	0.1	0.2	0.3	1.1	1.3	2.0	1.8	2.0	0.5- 0.9
2.1-3.0	14.5	10.2	6.2	3.1	1.5	1.3	1.2	1.7	3.9	3.3	4.9	3.0	4.2	1.0- 1.3
3.1-4.0	11.6	12.6	8.3	4.1	3.2	2.7	4.0	4.0	6.9	5.2	6.4	3.5	5.7	1.4- 1.8
4.1-5.0	9.2	8.4	7.0	5.5	4.5	5.1	5.8	5.9	7.1	4.0	4.4	3.6	5.7	1.9- 2.2
5.1-6.0	6.3	6.1	5.6	6.9	5.4	5.5	7.2	6.6	7.0	4.6	3.2	2.8	5.6	2.3- 2.7
6.1-7.0	4.2	4.4	6.1	7.4	6.2	6.9	7.3	7.0	6.1	4.3	4.0	2.1	5.7	2.8- 3.1
7.1-8.0	3.7	3.8	5.1	6.8	6.2	6.7	8.8	8.1	5.9	4.6	3.8	5.1	5.9	3.2- 3.6
8.1-9.0	3.4	3.4	5.2	6.4	6.6	7.9	7.8	8.4	6.1	6.6	7.2	8.0	6.6	3.7- 4.0
9.1-10.0	3.3	3.5	5.1	7.1	6.7	7.5	6.5	7.9	5.4	7.5	7.6	8.1	6.5	4.1- 4.5
10.1-11.0	4.3	2.4	5.7	6.7	6.6	7.2	5.9	5.9	6.4	7.6	5.5	4.7	5.9	4.6- 4.9
11.1-12.0	4.2	3.3	4.6	6.1	6.2	5.6	6.4	6.6	6.3	5.6	4.1	4.3	5.4	5.0- 5.4
12.1-13.0	3.7	3.5	5.7	5.4	5.8	6.1	6.3	5.3	6.3	6.2	4.9	4.2	5.4	5.5- 5.8
13.1-14.0	3.3	3.6	4.7	5.3	5.0	6.2	5.5	5.7	4.8	4.9	4.5	4.7	4.9	5.9- 6.3
14.1-15.0	2.5	3.3	4.5	4.8	5.5	5.1	4.5	5.0	4.9	5.1	4.5	3.3	4.6	6.4- 6.7
15.1-16.0	1.7	3.8	3.9	4.1	4.1	4.8	4.4	4.4	5.0	4.7	3.8	4.3	4.1	6.8- 7.2
16.1-17.0	1.9	4.2	4.0	3.4	4.9	4.4	3.5	3.9	3.5	4.8	3.5	4.7	3.9	7.3- 7.6
17.1-18.0	1.6	2.6	3.3	3.4	4.6	3.3	4.1	3.8	3.3	3.9	4.1	4.1	3.6	7.7- 8.0
18.1-19.0	1.6	2.4	2.2	3.1	4.5	2.9	2.6	2.3	2.6	3.4	4.2	4.3	3.1	8.1- 8.5
19.1-20.0	0.8	2.2	1.8	2.2	2.6	2.6	2.3	1.7	2.7	3.0	3.4	3.7	2.4	8.6- 8.9
20.1-25.0	3.2	7.9	6.0	5.4	7.9	6.5	5.1	4.6	4.2	8.5	9.4	13.1	6.7	9.0-11.2
25.1-30.0	1.1	2.6	1.5	1.2	1.6	1.4	0.5	0.6	0.5	0.7	2.9	4.6	1.5	11.3-13.4
30.1-35.0	0.2	0.6	0.2	0.4	0.1	0.3	0.0	0.0	0.1	0.1	1.0	1.7	0.4	13.5-15.6
35.1-40.0	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.2	0.1	15.7-17.9
>40.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	>17.9
AVERAGE SPEED (MPH)	7.2	9.7	10.0	10.7	11.7	11.3	10.6	10.5	10.2	11.6	12.1	13.4	10.8	
AVERAGE SPEED (M/SEC)	3.2	4.4	4.5	4.8	5.2	5.1	4.7	4.7	4.5	5.2	5.4	6.0	4.8	
AVERAGE WIND POWER (WATTS/M**2)	132.1	252.9	209.4	226.9	256.0	235.5	188.7	185.0	180.6	246.4	349.8	415.3	237.6	
PERCENT DATA RECOVERY	34.3	32.1	39.8	50.5	53.0	40.7	37.9	51.0	24.1	39.3	40.7	26.9	39.3	

ANEMOMETER HEIGHT = 4 METERS = 13 FEET

NUMBER OF OBSERVATIONS = 23961

PERCENTAGE DATA RECOVERY = 39.3

SOURCE: GORESEARCH, INC.

WHITEHALL FAA AIRPORT

JEFFERSON COUNTY

The Whitehall airport site was located 5 miles southwest of Whitehall at 45°49'12" N and 112°12'00" W (Site No. 63 on Map II-1). Elevation at the airport, located in the Jefferson valley, is 4,600 feet. To the south are the Tobacco Root Mountains, which rise to more than 10,000 feet. Bull Mountain, with a summit of about 7,500 feet, lies to the north. West of the site are peaks in the Deerlodge National Forest, with summits ranging from 8,000 to 10,000 feet.

Most of the land in the valley is privately owned. Some sections west of the site are owned by the state. Land in the mountains is controlled predominantly by the Bureau of Land Management and the U.S. Forest Service.

Electrical service in the area is provided by the Montana Power Company and by the Vigilante Electric Cooperative. Many transmission lines run through the area. Commercial airports are located at Whitehall, Butte, Belgrade, and Helena.

Meteorological data were collected at this site for several years by the Federal Aviation Administration. These data, primarily collected for aviation and weather forecasting uses, consist of short-term (5 minutes or less) averages of wind speed and wind direction, as well as other meteorological parameters. Data were gathered once per hour. The data have been analyzed by Battelle Pacific Northwest Laboratories. The Battelle data set was derived from hourly observations made from January 1, 1948, through December 31, 1954. The anemometer was mounted on a ground mast at a height of 9.1 meters. The site is representative of a limited area in the Jefferson River Valley. More recent monitoring by Montana DNRC found lower speeds in the immediate area; however, BPA found even higher wind speeds at the microwave tower northeast of town.

Average monthly wind speeds varied from 9.8 miles per hour in August to 17.7 miles per hour in January. Average annual wind speed was 13.2 miles per hour.

Average monthly wind power ranged from 132.0 watts/m² in August to 794.0 watts/m² in January. Average annual wind power was 325.0 watts/m².

Average wind speeds were 10.8 miles per hour in summer, 12.1 miles per hour in autumn, 12.7 miles per hour in spring, and 17.0 miles per hour in winter. During all seasons, the highest average wind speeds occurred in mid-afternoon. The lowest average speeds occurred in mid-morning in winter, and from around 0600 to 0700 MST during the other seasons.

The diurnal range of average wind speeds was greatest in summer and least in winter. Most of the variation in average wind speeds among the seasons was due to differences in the average nighttime wind speed; however, wind speeds were significantly greater during the winter than they were at all hours during the other seasons.

The most common wind directions at the site were south-southwest through southwest. Winds from the east-northeast through south-southeast were least common. By direction, average wind speeds varied from 6.3 miles per hour for winds from the southeast to 22.6 miles per hour for winds from the south-southwest. The highest average wind speeds were those from the most common wind directions.

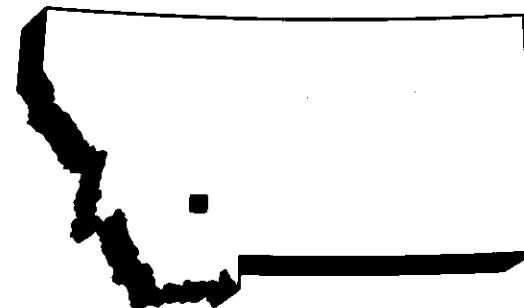


Table IV - 88

Monthly Wind Speed Distribution

JEFFERSON COUNTY - WHITEHALL FAA AIRPORT

01/01/48 - 12/31/54

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM (<1.1)	5.3	4.6	4.7	5.2	5.1	4.7	6.1	6.4	7.2	6.9	6.3	4.1	5.5	CALM (<0.5)
1.1- 3.1	4.1	3.6	4.2	2.9	3.8	3.6	3.4	4.6	4.1	3.9	3.1	3.0	3.7	0.5- 1.4
3.4- 5.4	11.8	12.1	14.1	12.9	14.3	13.8	16.0	20.2	19.2	20.1	14.2	11.9	15.1	1.5- 2.4 S
S 5.6- 7.6	5.9	6.1	7.6	7.2	9.1	8.7	10.6	11.6	11.3	10.2	7.6	7.0	8.6	2.5- 3.4 P
P 7.8- 9.8	5.5	5.9	6.7	8.1	10.7	10.6	12.6	12.6	11.0	8.2	6.9	6.4	8.8	3.5- 4.4 E
E 10.1-12.1	9.0	10.4	13.0	16.1	18.4	20.3	19.2	17.0	16.7	13.1	11.8	10.1	14.6	4.5- 5.4 EED
E 12.3-14.3	3.0	5.0	6.2	6.8	6.8	6.4	6.1	4.9	4.8	5.5	5.3	4.3	5.4	5.5- 6.4 D
D 14.5-16.6	5.0	5.2	6.9	6.8	6.6	6.6	5.7	5.4	5.6	4.8	5.6	4.5	5.7	6.5- 7.4
D 16.8-18.8	7.2	7.1	9.6	9.5	7.9	8.1	6.8	6.0	6.6	6.9	7.5	6.9	7.5	7.5- 8.4 M
M 19.0-21.0	6.3	7.1	7.9	8.5	6.4	6.4	4.7	3.9	4.5	5.4	7.4	7.3	6.3	8.5- 9.4
I 21.3-23.3	4.9	5.1	4.3	4.4	3.0	2.8	2.0	1.8	2.5	3.2	4.6	5.0	3.6	9.5-10.4 T
L 23.5-25.5	5.5	4.8	4.0	4.1	2.8	2.6	2.3	1.9	2.2	3.1	4.2	5.1	3.6	10.5-11.4 E
E 25.7-27.7	6.6	7.2	4.3	3.6	2.5	2.7	2.0	1.6	2.2	3.4	4.9	6.8	4.0	11.5-12.4 R
S 28.0-30.0	5.0	4.7	2.8	1.9	1.3	1.3	1.0	0.9	1.0	1.7	4.1	5.7	2.6	12.5-13.4 S
/ 30.2-32.2	2.8	2.9	1.3	0.7	0.4	0.6	0.5	0.3	0.4	0.9	1.4	2.9	1.3	13.5-14.4 /
H 32.4-34.4	3.4	3.3	1.3	0.5	0.4	0.5	0.5	0.4	0.4	0.9	2.0	2.7	1.3	14.5-15.4 S
O 34.7-36.7	1.5	1.4	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.4	0.8	1.4	0.5	15.5-16.4 E
U 36.9-38.9	1.3	1.0	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.3	0.7	1.1	0.4	16.5-17.4 C
R 39.1-41.2	1.4	0.9	0.2	0.2	0.0	0.1	0.1	0.1	0.1	0.3	0.6	1.0	0.4	17.5-18.4 O
41.4-43.4	0.8	0.8	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.1	0.4	0.7	0.3	18.5-19.4 N
43.6-45.6	0.8	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.6	0.2	19.5-20.4 D
45.9-56.8	2.1	0.4	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.2	0.3	1.4	0.4	20.5-25.4
57.0-68.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	25.5-30.4
68.2-79.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.5-35.4
79.4-90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5-40.4
>90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>40.4
AVERAGE SPEED (MPH)	17.7	16.3	13.4	13.0	11.6	11.9	10.7	9.8	10.3	11.6	14.3	17.0	13.2	
AVERAGE SPEED (M/SEC)	7.9	7.3	6.0	5.8	5.2	5.3	4.8	4.4	4.6	5.2	6.4	7.6	5.9	
AVERAGE WIND POWER (WATTS/M**2)	794.0	521.0	295.0	243.0	181.0	182.0	154.0	132.0	143.0	244.0	397.0	623.0	325.0	

ANEMOMETER HEIGHT = 30.0 FEET = 9.1 METERS

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 89
 Percentage Frequency Summary for Wind Speed
JEFFERSON COUNTY - WHITEHALL FAA AIRPORT (WINTER)

01/01/48 - 12/31/54

		WIND SPEED (MPH)																		
		<0.5	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	AV SPEED (MPH)	AV SPEED (M/SEC)	
		<1.1	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2			
		1	5.7	5.7	14.9	4.0	5.3	10.2	3.8	4.6	7.3	6.7	4.4	4.2	8.4	4.0	1.6	9.3	16.1	7.2
		2	7.3	4.5	11.9	6.7	6.7	9.2	3.8	5.7	7.6	6.0	3.5	5.4	6.5	4.0	1.3	10.0	15.9	7.1
		3	7.0	4.1	14.6	6.7	4.9	10.3	2.5	4.8	7.6	6.0	4.9	6.2	4.6	3.5	3.0	9.4	15.8	7.1
		4	6.6	4.7	15.3	5.1	4.6	9.4	3.4	5.6	4.9	7.3	4.6	5.4	6.8	4.7	1.7	9.8	16.2	7.3
		5	6.5	3.3	15.2	7.9	5.7	9.2	3.7	3.6	5.1	6.0	4.6	6.0	6.0	4.4	2.5	10.3	16.2	7.3
		6	6.2	5.2	12.5	7.0	5.7	11.2	5.0	4.4	5.2	4.6	5.1	3.8	5.9	6.3	3.5	8.4	16.0	7.2
		7	6.4	5.2	14.2	8.9	5.6	9.6	3.9	3.2	6.7	4.9	4.4	5.4	6.8	4.4	2.1	8.4	15.3	6.8
		8	6.5	4.4	17.9	7.5	4.9	9.2	3.8	4.8	5.1	7.0	3.8	4.9	4.8	4.8	2.6	8.2	15.1	6.7
H		9	4.9	5.8	16.2	7.1	7.9	9.5	2.9	4.4	6.2	6.2	4.9	3.8	5.4	3.9	2.9	8.0	15.0	6.7
O		10	5.4	4.1	14.6	8.6	6.4	8.2	2.5	3.6	6.7	7.3	4.9	4.0	6.5	3.5	4.8	9.1	16.2	7.2
U		11	5.2	3.5	10.2	7.4	4.1	8.8	3.3	4.1	7.3	6.7	6.2	4.4	7.8	5.2	3.8	11.9	18.1	8.1
U		12	2.9	3.2	9.7	5.3	6.7	7.3	4.3	4.2	5.3	6.0	4.6	6.5	10.3	7.7	3.2	13.1	19.4	8.7
R		13	3.3	2.1	7.9	5.4	6.0	6.3	2.8	3.8	7.3	6.1	4.8	6.5	8.4	8.4	4.4	16.5	20.7	9.3
R		14	2.2	1.7	6.8	3.9	5.9	8.4	3.5	3.8	7.2	7.4	5.9	5.6	9.5	8.5	5.9	14.0	21.1	9.4
R		15	1.9	1.7	6.8	3.5	4.3	8.4	3.7	4.8	7.9	10.1	4.9	4.8	10.4	7.1	4.4	15.2	21.3	9.5
R		16	1.7	1.6	7.8	3.6	5.2	8.4	5.1	5.2	7.5	9.6	6.0	7.9	8.7	7.1	3.5	11.0	20.1	9.0
R		17	2.2	1.6	7.8	5.6	5.7	9.9	4.8	7.1	8.2	10.1	5.8	6.2	6.8	6.3	2.5	9.3	18.6	8.3
R		18	1.9	1.3	7.9	6.5	7.9	14.1	5.4	6.8	8.5	8.2	5.4	5.7	5.9	3.6	4.0	6.8	17.2	7.7
R		19	3.2	2.2	10.3	8.3	7.3	12.5	6.5	6.2	8.4	5.9	5.1	4.5	5.7	4.8	1.6	7.7	16.2	7.2
R		20	3.5	3.6	13.0	6.0	5.4	14.0	6.2	6.2	6.9	6.8	4.6	4.4	5.7	3.7	2.4	7.5	15.7	7.0
R		21	4.4	3.9	13.6	7.4	7.4	9.8	3.8	6.0	8.4	6.2	5.5	4.6	4.4	5.1	1.7	7.6	15.6	7.0
R		22	4.8	3.7	12.4	7.8	5.6	11.6	3.3	5.6	8.6	7.2	5.4	4.3	5.4	3.8	2.2	8.6	16.1	7.2
R		23	6.7	4.1	13.0	5.7	6.2	10.6	4.4	4.3	8.3	6.5	4.9	4.1	7.2	4.8	1.6	7.8	15.8	7.1
R		24	5.5	4.3	12.0	6.7	6.7	10.0	5.5	4.8	7.3	7.0	5.2	5.5	6.1	4.3	1.9	7.3	15.9	7.1
ALL HOURS		4.7	3.6	11.9	6.3	5.9	9.8	4.1	4.9	7.1	6.9	5.0	5.1	6.9	5.1	2.9	9.8	17.0	7.6	

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 90

Percentage Frequency Summary for Wind Speed

JEFFERSON COUNTY - WHITEHALL FAA AIRPORT (SPRING)

01/01/48 - 12/31/54

	WIND SPEED (MPH)															AV	AV		
	<0.5	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	AV	AV	
		1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	9.4	10.4	11.4	12.4	13.4	14.4	>14.4	(MPH)	(M/SEC)	
		1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2	AV	AV	
		3.1	5.4	7.6	9.8	12.1	14.3	16.6	18.8	21.0	23.3	25.5	27.7	30.0	32.2	>32.2	(MPH)	(M/SEC)	
1	7.3	4.5	19.1	11.7	8.4	16.8	5.6	5.8	7.0	6.6	2.5	1.0	2.3	0.6	0.0	0.8	10.2	4.6	
2	6.7	5.6	21.9	9.5	10.3	14.9	5.5	5.7	7.3	5.4	3.9	0.7	1.4	0.2	0.5	0.8	9.9	4.4	
3	8.9	5.1	20.8	8.1	9.5	15.8	5.1	5.6	7.5	4.5	2.6	2.1	2.3	0.8	0.5	0.8	10.1	4.5	
4	8.5	7.5	17.5	12.3	7.4	15.1	4.3	5.9	6.2	6.9	2.0	2.3	2.3	1.1	0.6	0.0	10.0	4.5	
5	10.4	6.6	21.1	11.3	7.3	11.2	6.2	5.6	6.7	5.3	1.5	1.9	2.7	1.3	0.2	0.8	9.7	4.3	
6	11.0	6.2	20.5	10.0	7.8	14.3	5.4	4.2	7.3	3.6	2.5	2.8	2.2	1.4	0.3	0.5	9.6	4.3	
7	13.7	6.5	21.6	7.1	8.7	12.7	4.2	4.8	5.8	4.8	2.7	3.6	2.2	0.9	0.2	0.6	9.5	4.2	
8	11.2	6.5	18.2	8.9	7.0	13.4	6.5	5.4	6.0	7.2	2.2	2.3	2.3	1.6	0.3	1.1	10.3	4.6	
H	9	6.2	5.1	14.9	8.4	10.1	13.2	6.7	7.1	7.5	6.2	4.5	3.6	3.1	2.0	0.2	1.2	11.9	5.3
O	10	3.2	4.3	13.5	8.7	7.2	16.6	6.5	4.8	8.9	6.5	5.3	4.0	4.4	3.3	1.1	1.6	13.4	6.0
O	11	3.4	3.4	10.7	8.0	7.6	15.4	5.9	6.5	8.1	6.2	5.8	3.9	6.5	4.5	0.8	3.3	14.6	6.5
U	12	2.8	2.2	11.8	7.5	6.9	15.0	5.6	5.1	8.3	8.4	5.0	6.6	5.3	3.6	2.6	3.3	15.2	6.8
R	13	1.6	1.3	9.5	6.7	8.3	13.4	6.3	6.6	9.2	9.5	5.1	6.4	6.3	4.7	1.9	3.5	16.1	7.2
R	14	0.8	0.9	7.8	5.4	7.3	14.2	7.6	5.9	10.9	11.2	5.6	6.8	6.9	3.8	1.9	3.2	16.6	7.4
R	15	0.9	1.1	7.1	4.7	7.1	14.6	7.6	6.8	12.9	10.1	6.0	5.6	6.8	3.3	1.9	3.4	16.6	7.4
R	16	1.0	0.9	5.0	4.8	6.7	16.5	5.8	7.1	13.2	11.7	6.4	7.9	5.5	4.3	1.1	2.4	16.8	7.5
R	17	1.3	1.4	6.1	3.1	6.7	14.0	7.0	8.4	15.4	12.9	6.4	6.5	5.0	1.9	1.9	2.2	16.5	7.4
R	18	0.8	0.9	6.9	5.4	7.0	17.3	7.8	8.6	12.1	12.4	5.9	4.7	3.7	2.4	1.4	2.7	15.8	7.1
R	19	0.6	1.1	7.1	5.9	9.2	20.7	9.2	11.5	12.0	8.1	3.4	4.7	3.2	1.8	0.3	1.1	14.4	6.4
R	20	1.7	2.5	8.9	6.7	10.6	22.0	8.0	10.4	10.2	8.4	4.4	2.2	2.0	1.4	0.3	0.3	13.0	5.8
R	21	3.3	3.1	11.5	7.9	11.2	20.2	8.7	9.0	8.8	8.1	2.7	2.5	1.1	0.9	0.8	0.3	12.1	5.4
R	22	3.3	2.8	15.9	10.1	11.5	17.6	7.8	8.2	9.8	4.2	3.1	2.5	1.7	0.3	0.5	0.8	11.4	5.1
R	23	5.9	3.9	16.9	8.5	9.6	17.2	7.3	7.2	7.9	8.1	1.7	0.8	3.0	0.9	0.5	0.7	11.0	4.9
R	24	5.6	4.4	16.1	11.5	10.4	18.2	7.0	6.2	7.0	5.9	2.3	2.1	1.4	0.8	0.3	0.6	10.7	4.8
ALL HOURS	5.0	3.6	13.8	8.0	8.5	15.8	6.6	6.8	9.0	7.6	3.9	3.6	3.5	2.0	0.8	1.5	12.7	5.7	

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 91
Percentage Frequency Summary for Wind Speed
JEFFERSON COUNTY - WHITEHALL FAA AIRPORT (SUMMER)

01/01/48 - 12/31/54

		WIND SPEED (MPH)																	
<0.5		0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	AV	AV	
<1.1		1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-	>32.2	SPEED (MPH)	SPEED (M/SEC)	
		7.1	4.7	22.1	13.4	14.2	19.1	5.6	3.9	4.4	3.0	0.5	1.1	0.7	0.2	0.0	0.3	8.5	3.8
		8.5	7.6	22.7	13.2	14.6	17.2	4.0	3.3	3.3	2.8	0.9	0.9	0.5	0.2	0.0	0.2	7.8	3.5
		8.6	7.8	27.8	13.2	14.1	13.8	4.4	3.6	2.6	1.9	0.5	0.9	0.2	0.5	0.0	0.2	7.4	3.3
		10.6	8.3	28.1	14.4	11.2	12.8	3.6	3.5	3.6	2.8	0.6	0.3	0.0	0.2	0.0	0.0	7.0	3.1
		14.0	8.1	26.8	12.1	10.4	15.8	3.7	2.2	3.6	1.3	1.1	0.3	0.2	0.3	0.0	0.2	6.7	3.0
		14.3	7.8	30.1	12.7	11.3	12.0	3.1	3.0	1.9	1.4	0.9	0.5	0.7	0.3	0.0	0.2	6.5	2.9
		17.4	11.6	26.9	10.9	9.7	10.9	2.0	2.9	2.2	2.6	0.6	1.1	0.8	0.5	0.0	0.0	6.4	2.9
		13.5	7.5	25.6	10.3	11.2	14.3	3.2	3.1	3.4	2.3	1.7	1.2	1.6	0.7	0.2	0.3	7.7	3.5
H	9	4.7	3.1	20.0	13.8	11.8	21.1	5.9	4.0	5.6	3.9	1.3	1.9	1.0	1.2	0.6	0.2	9.8	4.4
O	10	4.6	2.5	17.2	12.7	13.8	17.2	5.9	4.3	7.5	4.5	1.9	2.3	3.3	1.2	0.2	0.8	10.8	4.8
U	11	4.0	2.9	16.0	9.5	13.7	18.0	5.7	3.7	7.9	4.2	4.0	2.8	4.0	1.7	1.0	0.8	11.8	5.3
U	12	3.6	2.0	13.0	10.4	13.2	15.7	6.5	7.4	6.5	5.9	4.0	3.4	3.4	2.0	0.8	1.9	12.7	5.7
R	13	1.3	1.5	10.3	10.0	13.4	18.2	5.6	6.2	8.5	8.2	3.4	3.6	4.8	1.2	1.2	2.6	13.8	6.2
R	14	0.9	1.0	8.7	5.1	10.6	23.1	5.9	6.4	10.9	8.7	3.6	4.7	4.1	1.7	1.7	3.1	14.9	6.7
R	15	0.6	0.6	8.7	7.0	8.6	18.5	6.7	8.6	13.7	8.4	4.0	5.0	5.0	2.0	1.2	1.6	14.9	6.7
R	16	0.6	0.3	4.8	7.1	9.0	19.1	7.8	10.4	11.8	8.7	4.0	6.1	5.0	2.6	1.1	1.6	15.6	7.0
R	17	1.5	0.7	6.5	5.4	9.5	20.4	7.9	8.2	10.2	11.0	4.3	4.2	4.3	2.3	0.6	2.9	15.1	6.7
R	18	1.1	0.6	7.1	4.8	8.1	19.9	7.5	9.1	14.0	10.3	4.3	4.5	3.3	2.0	1.2	2.3	15.3	6.8
R	19	1.7	1.1	5.9	6.8	8.5	24.3	8.1	9.2	12.0	8.9	4.0	3.1	2.8	1.9	0.9	0.8	14.1	6.3
R	20	2.3	2.0	7.8	8.4	11.8	25.5	7.6	10.6	10.6	5.1	2.5	2.6	1.9	1.1	0.0	0.2	12.4	5.5
R	21	2.7	2.8	10.0	11.4	13.2	25.9	8.4	7.6	6.5	6.4	1.6	1.1	1.2	0.8	0.0	0.5	11.3	5.0
R	22	3.1	1.6	14.6	11.5	14.6	25.0	8.2	8.4	7.2	1.9	1.4	0.8	0.8	0.3	0.3	0.3	10.4	4.6
R	23	4.2	3.9	18.5	11.6	14.0	23.8	5.3	6.8	5.2	3.4	0.8	0.9	0.5	0.6	0.2	0.3	9.5	4.3
R	24	6.2	2.6	21.3	11.8	16.6	20.4	6.4	4.8	4.5	2.4	1.1	1.6	0.2	0.3	0.0	0.0	8.9	4.0
ALL HOURS		5.7	3.9	16.7	10.3	11.9	18.8	5.8	5.9	7.0	5.0	2.2	2.3	2.1	1.1	0.5	0.8	10.8	4.8

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 92

Percentage Frequency Summary for Wind Speed

JEFFERSON COUNTY - WHITEHALL FAA AIRPORT (AUTUMN)

01/01/48 - 12/31/54

	WIND SPEED (MPH)													AV	AV				
	0.5-	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	>14.4	SPEED	SPEED		
	1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	9.4	10.4	11.4	12.4	13.4	14.4	>32.2	(MPH)	(M/SEC)		
	WIND SPEED (M/SEC)																		
	1.1-	3.4-	5.6-	7.8-	10.1-	12.3-	14.5-	16.8-	19.0-	21.3-	23.5-	25.7-	28.0-	30.2-					
	3.1	5.4	7.6	9.8	12.1	14.3	16.6	18.8	21.0	23.3	25.5	27.7	30.0	32.2					
1	9.1	6.2	21.9	11.6	10.4	13.4	3.0	3.6	5.2	4.1	2.5	2.7	2.2	1.4	1.1	1.6	10.0	4.5	
2	10.0	4.6	23.7	11.4	9.1	13.7	3.6	3.5	4.9	4.5	2.8	2.2	2.2	1.6	0.8	1.5	9.8	4.4	
3	9.1	5.8	23.1	11.8	9.1	12.3	3.7	4.4	5.7	3.6	2.0	1.9	2.8	1.9	0.6	2.3	10.1	4.5	
4	11.2	5.4	25.9	11.2	9.5	8.3	5.7	3.3	4.7	3.0	3.6	1.6	2.1	1.4	0.8	2.6	9.6	4.3	
5	10.8	5.4	27.2	10.9	7.5	10.2	1.9	3.0	6.0	3.9	2.7	2.4	3.5	1.9	1.1	1.8	10.0	4.5	
6	10.8	6.2	25.6	11.5	8.5	10.5	3.4	2.8	4.1	5.1	2.0	2.7	1.1	2.0	0.3	3.4	9.8	4.4	
7	13.9	5.8	24.7	10.7	6.6	9.5	4.3	3.8	4.4	4.9	2.2	2.5	1.7	1.3	0.3	3.5	9.6	4.3	
8	14.3	6.0	24.7	10.2	6.9	8.7	3.1	3.6	4.4	5.3	3.6	1.3	2.7	2.4	0.5	2.4	9.7	4.3	
H	9	8.8	5.3	24.0	9.4	8.8	11.9	3.9	3.9	5.2	3.9	1.5	3.0	4.2	2.5	1.3	2.3	10.6	4.8
O	10	6.1	3.4	19.3	9.6	9.3	14.5	4.2	3.6	5.8	5.0	3.3	4.9	3.6	3.0	1.1	3.3	12.4	5.5
U	11	5.0	2.2	14.6	7.7	8.8	13.7	5.2	6.0	5.8	6.6	4.1	4.9	6.9	3.3	1.7	3.6	14.2	6.4
R	12	2.4	2.5	12.6	9.2	8.5	9.7	5.8	6.1	7.5	8.3	4.4	5.5	6.0	4.7	2.2	4.6	15.4	6.9
	13	2.8	2.1	10.7	8.3	7.4	12.0	3.9	4.9	6.9	9.3	7.0	6.0	7.2	4.6	1.9	5.2	16.2	7.2
	14	2.4	1.4	11.9	6.8	7.1	11.5	3.9	6.6	10.3	8.8	6.3	5.8	7.5	3.6	1.8	4.5	16.2	7.2
	15	2.8	1.7	9.9	6.8	8.2	11.6	6.3	6.6	9.4	8.3	7.5	5.8	6.9	4.1	0.6	3.5	15.8	7.1
	16	1.7	1.6	10.2	7.5	8.0	13.4	6.6	6.0	12.9	11.5	4.1	5.5	4.1	3.0	1.2	2.9	15.2	6.8
	17	2.7	0.9	8.8	7.4	8.2	17.3	7.5	11.4	10.7	8.3	4.4	3.8	3.5	2.2	0.5	2.6	14.3	6.4
	18	1.9	2.5	9.8	7.4	9.9	22.4	8.1	8.5	10.2	6.9	3.9	2.5	2.2	1.1	0.7	2.1	13.3	5.9
	19	3.8	2.4	10.7	9.8	11.2	21.3	8.1	7.1	10.4	5.2	2.8	1.4	1.9	1.4	0.5	2.1	12.4	5.5
	20	3.1	3.6	14.3	9.3	12.6	17.6	8.5	8.5	9.0	3.3	1.9	2.3	2.5	1.4	0.5	1.8	11.9	5.3
	21	6.1	2.6	17.3	9.5	8.5	20.7	8.8	4.5	6.1	6.0	2.3	1.9	2.5	1.0	0.3	2.0	11.2	5.0
	22	6.3	3.9	18.5	12.1	7.9	18.5	6.6	5.2	6.6	3.5	1.9	2.5	1.9	2.2	0.6	1.9	11.0	4.9
	23	9.0	4.1	17.5	11.7	9.8	14.6	6.0	5.9	6.4	3.8	3.6	1.3	2.5	1.7	0.5	1.8	10.7	4.8
	24	8.7	3.5	22.1	12.3	8.0	15.3	3.3	5.2	5.5	5.4	2.5	2.2	2.4	1.0	0.6	2.1	10.4	4.6
ALL HOURS	6.8	3.7	17.9	9.7	8.7	13.9	5.2	5.3	7.0	5.8	3.4	3.2	3.5	2.3	0.9	2.7	12.1	5.4	

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Table IV - 93
Annual Wind Rose Distribution
JEFFERSON COUNTY - WHITEHALL FAA AIRPORT
01/01/48 - 12/31/54

DIRECTION>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	<DIRECTION	
SPEED (MPH)																		SPEED (M/SEC)	
1.1- 3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5- 1.4		
3.4- 5.4	0.5	0.1	0.3	0.1	0.2	0.0	0.2	0.1	0.5	0.0	0.4	0.1	0.4	0.1	0.4	0.1	3.5	1.5- 2.4 S	
5.6- 7.6	1.5	0.6	1.3	0.4	0.8	0.2	0.9	0.3	1.3	0.5	1.7	0.6	1.7	0.8	2.0	0.6	15.2	2.5- 3.4 P	
7.8- 9.8	0.7	0.4	0.8	0.2	0.4	0.1	0.3	0.2	0.8	0.3	1.0	0.5	0.8	0.6	1.2	0.3	8.6	3.5- 4.4 E	
10.1-12.1	0.6	0.4	1.0	0.3	0.3	0.1	0.3	0.2	0.8	0.4	0.9	0.5	0.9	0.6	1.0	0.4	8.7	4.5- 5.4 E	
12.3-14.3	0.8	0.9	1.8	0.6	0.4	0.1	0.3	0.3	1.3	1.1	1.8	0.9	1.5	1.1	1.1	0.5	14.5	5.5- 6.4 D	
14.5-16.6	0.2	0.4	0.7	0.2	0.1	0.0	0.1	0.1	0.5	0.6	0.9	0.3	0.5	0.4	0.3	0.1	5.4	6.5- 7.4 D	
16.8-18.8	0.2	0.4	0.8	0.2	0.1	0.0	0.0	0.1	0.5	0.8	1.0	0.3	0.5	0.5	0.3	0.1	5.8	7.5- 8.4 M	
M	19.0-21.0	0.1	0.6	0.8	0.2	0.1	0.0	0.0	0.1	0.7	1.4	1.6	0.4	0.5	0.7	0.3	0.1	7.6	8.5- 9.4 E
I	21.3-23.3	0.1	0.4	0.5	0.2	0.0	0.0	0.0	0.1	0.6	1.6	1.4	0.3	0.4	0.5	0.2	0.0	6.3	9.5-10.4 T
L	23.5-25.5	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.3	1.2	0.9	0.2	0.2	0.2	0.1	0.0	3.6	10.5-11.4 E
E	25.7-27.7	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.4	1.2	1.0	0.2	0.2	0.2	0.1	0.0	3.6	11.5-12.4 R
S	28.0-30.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.4	1.5	1.1	0.2	0.1	0.2	0.1	0.0	3.8	12.5-13.4 S
/	30.2-32.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	0.8	0.1	0.1	0.1	0.0	0.0	2.6	13.5-14.4 /
H	32.4-34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.4	0.0	0.0	0.1	0.0	0.0	1.1	14.5-15.4 S
O	34.7-36.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.4	0.0	0.0	0.1	0.0	0.0	1.2	15.5-16.4 E
U	36.9-38.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.4	16.5-17.4 C
R	39.1-41.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.4	17.5-18.4 O
	41.4-43.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.3	18.5-19.4 N
	43.6-45.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.3	19.5-20.4 D
	45.9-56.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	20.5-25.4
	57.0-68.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.4	25.5-30.4
	68.2-79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	30.5-35.4
	79.4-90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5-40.4
	>90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>40.4	
	CALM																5.5	CALM	
	TOTAL	4.9	4.7	8.6	2.6	2.4	0.8	2.1	1.5	8.7	14.1	16.0	4.8	8.0	6.2	7.0	2.2	100.1	TOTAL
AV SPD (MPH)	8.1	13.2	11.6	11.6	7.2	7.4	6.3	10.3	13.9	22.6	17.4	13.4	11.0	13.6	8.7	8.3	11.5	AV SPD (MPH)	
AV SPD (M/S)	3.6	5.9	5.2	5.2	3.2	3.3	2.8	4.6	6.2	10.1	7.8	6.0	4.9	6.1	3.9	3.7	5.2	AV SPD (M/S)	

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES

Figure IV - 10
Annual Wind Rose
WHITEHALL FAA AIRPORT — JEFFERSON COUNTY
(1984 - 1954)

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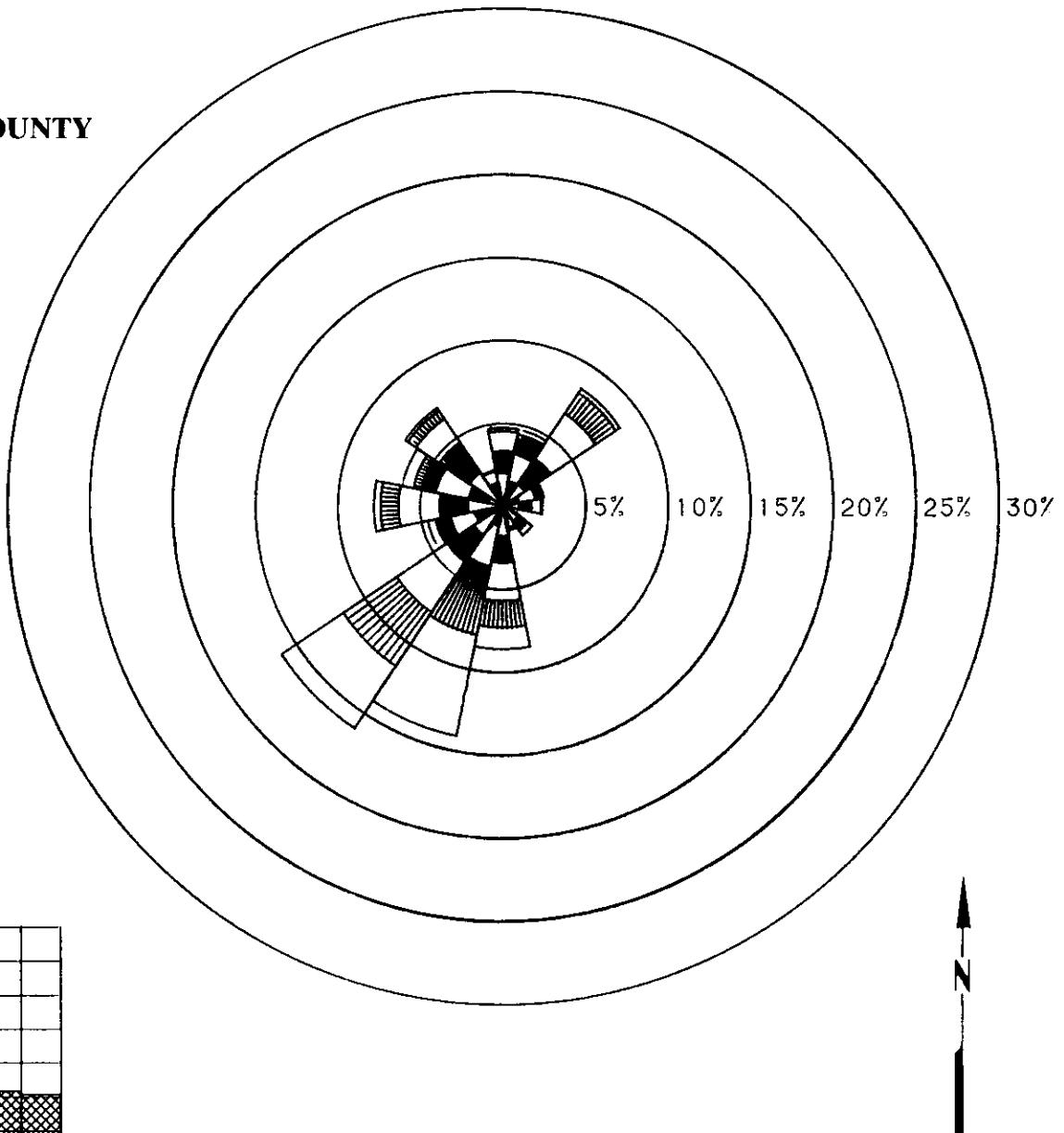
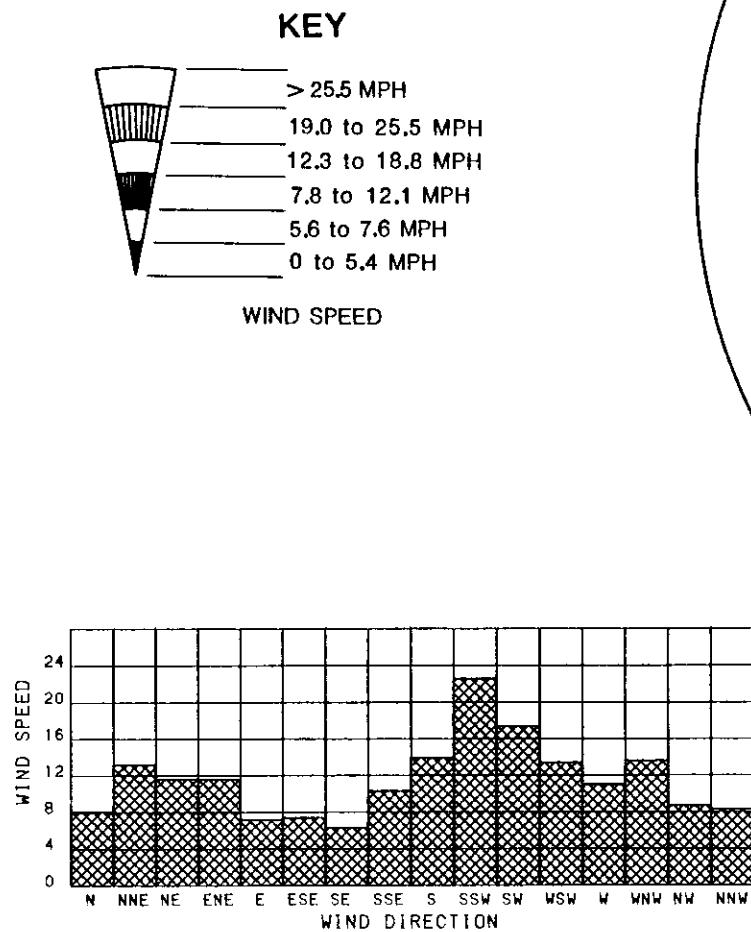


Table IV - 94
Coefficients of Weibull Distribution
JEFFERSON COUNTY - WHITEHALL FAA AIRPORT

01/01/48 - 12/31/54

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	9.2990	1.5450
FEBRUARY	8.4560	1.7370
MARCH	7.1330	1.8280
APRIL	7.1640	1.9410
MAY	6.4880	1.8700
JUNE	6.4630	1.9780
JULY	6.2620	1.8420
AUGUST	5.7630	1.7360
SEPTEMBER	5.9020	1.8540
OCTOBER	6.6140	1.6180
NOVEMBER	7.8100	1.7390
DECEMBER	8.9070	1.6910
YEAR	7.2800	1.6720

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES